

Project Number & Title 4B-122 Predicting the effects of fibre, grain digestion rate and the ileal brake on voluntary feed intake

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Aims and Objectives

The overall project aim was to quantify relationships between feed intake, fibre amount / type and grain starch digestion rate. This was achieved through three animal trials with the specific objectives of

- 1) establishing the effects of partially fermentable (wheat bran) and largely non-fermentable (oat hulls) fibres offered with highly digestible starch-based diets on feed intake and large intestinal (LI) fermentation in pigs.
- 2) determining feed intake and efficiency of nutritionally balanced diets based on grains (milled wheat and sorghum; steam-flaked wheat and sorghum) with widely different starch digestion rate at 5% insoluble fibre level, and their effects on LI fermentation.
- 3) identifying the effects of the same four grain-based diets, as influenced by insoluble fibre level (0, 5 and 20%), on the gastrointestinal tract passage rate, expressed as cumulative mean retention time in the stomach and small intestine (SI), determined with indigestible markers.

Key Findings

1. Inclusion of insoluble and non-fermentable fibre in the diet (e.g. oat hulls) at low levels (ca 5%) can increase feed intake. Even partly fermentable insoluble fibre such as wheat bran depresses intake in a dose-dependent manner.
2. Faecal pH is a potential indicator of the extent of SI digestion, as undigested starch at the end of the SI is fermented in the colon to short chain fatty acids and results in a lower faecal pH. This could be a useful on-farm check that feeds are efficiently digested, if data are collected over time to monitor feed processing batch variation effects.
3. Hydration capacity of feeds is a predictor of intake, particularly for highly digestible diets. The greater the hydration capacity, the lower the feed intake. This results directly from gastric structuring (increasing residence time) and/or indirectly from the enhanced microbial fermentation of more swellable fibres.

Application to Industry

Strategies to increase FI include (all of) the following:

1. Ensuring that all milled grain particles are below 1.0 mm (wheat/barley) or 0.8 mm (sorghum) to have a limited effect on gastric retention and rapid/complete digestion in the small intestine.
2. Addition of small quantities of non-fermentable fibre to stimulate passage rate (e.g. 5% oat hulls)
3. Avoiding dietary components with high hydration capacity and/or fermentability.

Strategies for decreased FI include (all of) the following:

1. Larger milled grain particle sizes to slow gastric emptying
2. Addition of large amounts of insoluble fibre irrespective of whether fermentable or not (e.g. 20% oat hulls or wheat bran), particularly for wheat-based diets.
3. Addition of other dietary components with high water holding capacity.